SECTION 15100

UNDERGROUND PIPING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Scope
   1. Provide each system, complete as shown, scheduled or specified.

B. Description Of Systems
   1. The WORK for each system includes, as appropriate to the design and location of the system, connections to existing work, required components, related earthwork, concrete work and testing, necessary to provide a complete, functioning system.
      a. STORM DRAINAGE (ST)
         1) TYPE CISP, CAST IRON SOIL PIPE or TYPE CISP-H, HUBLESS CAST IRON SOIL PIPE inside building to 5 feet outside building perimeter.
      b. SANITARY DRAINAGE (SAN)
         1) TYPE CISP, CAST IRON SOIL PIPE or, TYPE CISP-H, HUBLESS CAST IRON SOIL PIPE inside building to 5 feet outside building perimeter.
      c. CONDENSER WATER (CWS,CWR)
         1) TYPE CPR-U, COPPER TUBING.

C. Related Work Specified Under Other Sections
   1. Division 02 Section “Earthwork.”
   2. Division 02 Section “Sanitary Sewerage.”
   3. Division 02 Section “Storm Drainage.”
   4. Division 03 Section “Cast In Place Concrete.”
   5. Division 05 Section “Miscellaneous Metal Fabrications.”
   6. Division 15 Section “General Mechanical Requirements.”
   7. Division 15 Section “Aboveground Piping Systems.”

1.2 QUALITY ASSURANCE

A. Reference Specifications
   1. Division 02 Section “Soils And Aggregates.”

1.3 SUBMITTALS

A. Furnish submittals for items that are identified in this SECTION by a different typeface and a bracketed code (e.g., *Item [L]*). Refer to Division 01 Section “Shop Drawings, Product Data And Samples” for definition of codes for types of submittals and the administrative requirements governing submittal procedure. Additional submittal requirements pertaining to this SECTION are specified herein under this Article.

B. Include:
   1. Materials and equipment classification and identification.
   2. Component pressure/temperature rating.
   3. Piping and required supports , anchorage and restraints.
   4. Piping transition details.
   5. Special installation requirements.
   6. Catalog data.
   7. Deviations.

C. *Test reports [T]:* Submit copies of structural integrity, leakage and performance test data.

D. Certificate. Submit welder's qualifications before proceeding with the WORK.

E. Letter: Submit EPOXY BONDING COMPOUND manufacturer's detailed product application instructions.

1.4 RECORD DOCUMENTS

A. Submit as-built drawings and progress prints per Division 01 Section "Project Record Documents".

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operating and maintenance data, special tools and spare parts list, per Division 01 Section "Operating And Maintenance Data".

PART 2 PRODUCTS

2.1 PIPING MATERIALS

A. General
   1. Ells, tees, reducing tees, wyes, couplings, increasers, crosses, transitions and end caps shall be of the same Type and Class of materials as the pipe, or of material having equal physical and chemical properties.

B. Type CISP, Cast Iron Soil Pipe
   1. Hub and spigot: Per ASTM A 74, service weight pipe coated inside and outside with coal tar enamel. Pipe with eccentrically cast, thin walls will not be accepted.
   2. Elastomer gaskets: Single pipe weight use, per ASTM C 564.

C. Type CISP-H, Hubless Cast Iron Soil Pipe
   1. Hubless: ASTM A 888 and Cast Iron Soil Pipe Institute (CISPI) CISPI 301, service weight pipe coated inside and outside with coal tar enamel. Pipe with eccentrically cast, thin walls will not be accepted.
   2. Joint: Conforming to CISPI 301 and ASTM A 888 use of a neoprene sleeve and two stainless steel clamps per joint.

D. Type CPR-U, Copper Tubing
   1. Seamless: Type K, per ASTM B 88. Wrought copper socket joint fittings per ANSI B16.22; brazed socket cup depth per MIL-F-1183. Joints shall be brazed except as otherwise specified.

E. Piping Transitions
   1. *Transitions [P]:* Provide for joining two different types of pipe materials such as cast iron, clay, steel, copper or plastic. Fabricate transitions with bushings capable of resisting normal moisture corrosion.
      a. Harsco Corp. “CT-Adapters”.
      b. Fernco Joint Sealer Co. “PVC Donut”.
      c. Joints, Inc. “Caulder”.

## 2.2 DRAINAGE SPECIALTIES

A. Wall Pipes
   1. Cast iron: Class D, bell and flange, flange and plain end, or plain end and mechanical joint, as indicated.
      a. Clow.
      b. American Cast Iron Pipe.
      c. United States Pipe & Foundry Co.

B. P-Trap
   1. P-Trap: Extra heavy cast iron for connection to TYPE CISP piping.

C. Type HO, Hub Outlet
   1. Type HO, Hub Outlet: Hub end of TYPE CISP pipe.

## 2.3 MISCELLANEOUS MATERIALS

A. *Bituminous Coating [P]*:
   1. Carboline “Bitumastic 50”.
   2. Porter International, Div. of Courtaulds Coatings. “Tarmastic 101”.

B. *Standard packing [P]:* Tarred oakum or jute per FS A-A-1186 Type II.

C. Sleeves: Standard weight black carbon steel pipe with anchor lugs except where continuously welded seal rings are indicated.

D. *Mechanically-expandable elastomer seal devices [P]*:
   1. Thunderline Corp. Wayne, MI., “Link Seal”.
   2. Metraflex, “Metraseal”.

E. *Gasket Join Lubricant [P]:* Use either pipe manufacturer’s recommended gasket lubricant or a hydrated bentonite gel applied per manufacturer’s instructions as joint lubricant.
   1. American Colloid Co. “Volclay”.

F. *Epoxy Bonding Compound [P]:* Two-component system suitable for bonding wet or dry concrete to each other and to other materials.
   1. Euclid Chemical Co. “Epoxy No. 452”.
   2. L&M Construction Chemicals Inc. “Epobond”. .
   3. Protex Ind. “Probond ET-150”.
   4. Sika Chemical Co. “Sikadur 32 Hi-Mod”.

G. Embedment (Bedding and Initial Backfill). Refer to Division 02 Section “Soils and Aggregates” for definitions of soils and aggregates, their uses and installation methods.

H. Concrete. Per ACI 301. Design concrete mix to provide a compressive strength of 3000 PSI per ASTM C 94.

## 2.4 MARKING TAPE

A. *Service [P]:* Identified 3 inch wide, orange color foil-backed polyethylene tape. Sewer service.
   1. Reef Industries, Inc.
   2. Allen Systems, Inc.
   3. Seaton Name Plate Corp.

# PART 3 EXECUTION

## 3.1 GENERAL

A. The following construction methods are not intended to be completely detailed. Provide properly functioning systems per applicable referenced codes, manufacturer’s instructions and standards and best accepted safe practice of the Trade.

## 3.2 EXISTING UTILITIES AND SERVICES

A. General
   1. Do not interrupt utilities and services to other facilities on the premises without written permission of the OWNER; provide protection from damage for such utilities and services; provide temporary services if interruption interferes with OWNER’S operations.
   2. At least 30 days prior to start of demolition, give notice in writing, to the utility companies, service companies, and public authorities having interests, to allow them time to do appropriate preparatory work. Submit a copy of such notice to the ARCHITECT-ENGINEER for information.
   3. The OWNER will shut off the utilities and services serving the structures to be demolished. The OWNER will disconnect and seal the utilities and services. The disconnecting and sealing shall be done:
      a. At points just beyond limits of demolition.
      b. At property lines or at meter pits adjacent thereto.
   4. If utility or service lines, materials and equipment are to be removed from service, secure written permission from the owning companies or public authorities of this intent.

5. For utilities or services remaining in service, protect the lines from damage due to operations of the CONTRACT. Reroute utilities or services on a temporary basis as necessary to avoid damage due to operations of the CONTRACT; restore to original locations when conditions allow. Repair damage caused by operations of this CONTRACT.
6. Definitions. The following definitions apply to work under this Article:
    a. "Remove". Means to excavate, to remove utility or service, to seal ends at disconnection points and to backfill.
    b. "Abandon". Means to seal the ends at disconnection points and to leave utility or service in place. Where indicated, fill the abandoned lines with concrete.
7. For utilities and services to be removed from service, remove as required to clear the area for WORK of this CONTRACT.
8. For utilities and services to be abandoned, leave materials and equipment in place that do not interfere with operations or WORK of this CONTRACT.
9. Permanent seals shall consist of:
    a. Masonry or concrete bulkhead, or plate with concrete support, for ends of utilities and services removed from service or abandoned, and for non-pressure seals on lines in service.
    b. Plugs or caps appropriate to the type of pipe, with required permanent thrust restraint at terminations, for pressure lines in service.

B. New Connections
1. Make complete connections to new or existing structures. Repair damage caused as a result of WORK. Repair the work to comply with the CONTRACT DOCUMENTS at no increase in the CONTRACT sum.

## 3.3 PIPING EARTHWORK

A. Excavation And Backfill
1. Perform excavating and backfilling required for the WORK per Division 02 Section "Soils And Aggregates," Division 02 Section "Earthwork," and the following requirements.
2. Excavate to approximate bottoms and trim to lines and elevations in manner specified under EMBEDMENT. Use manual methods in areas adjacent to buried construction and utilities to avoid damage or unscheduled service interruption. Limit trench width or embankment conditions to preclude excessive earth loads on installed piping systems.
3. TRENCH BACKFILL starts at top of EMBEDMENT.

B. Embedment (Bedding And Initial Backfill)
1. Embedment extends from trimmed trench elevation to 12 inches above top of pipe or component or to other dimensions indicated. Trim rough trench to subgrade.
    a. Provide bedding and initial backfill as defined in Division 02 Section "Soils And Aggregates," and as indicated.
    b. Provide concrete bedding/encasement and initial backfill as indicated.
2. Provide stable, uniform support consisting of minimum compacted thickness below bottom of exterior surface of pipe, including bell, equal to 1/8 of the outside diameter of pipe but in no case less than 4 inches unless otherwise indicated. Shape bedding to provide full

length barrel support and to prevent point loading at pipe joints. Place and compact embedment per Division 02 Section “Soils And Aggregates.”

3. When the bottom of the excavation cannot support the pipe, excavate to further depth and width and refill to pipe laying grade with bedding material per Division 02 Section “Soils And Aggregates.”

## 3.4 PIPING INSTALLATION

A. General

1. Prior to lowering pipe into trench, clean, visually inspect for apparent defects and tap pipe to audibly detect hidden defects. Remove defective pipe from the site promptly. Prior to and during laying of pipe, maintain excavations dry and clear of water and extraneous materials. Provide minimum 4 inches of clearance in all directions for pipe passing under or through building grade beams.
2. Where pipe is embedded in an underground concrete structure, provide as indicated an elastomer joint within 12 inches of exterior surface of the structure, capable of absorbing movement without leakage.
3. Where connections between different piping materials are made, use manufactured “specials” and “transitions” to produce permanently tight joints.
4. Clean and lubricate elastomer joints prior to assembly. Check recessed gaskets with feeler gages.
5. Locate WORK at elevations to ensure proper surface drainage.
6. During the progress of construction, protect open ends of 18 inch and smaller pipe, fittings, and valves to prevent the admission of foreign matter. Place plugs or flanges in the ends of all installed work whenever work stops. Plugs shall be commercially manufactured products.

B. Type CISP, Cast Iron Soil Pipe

1. Install per CISPI Cast Iron Soil Pipe and Fittings Handbook except as modified by the CONTRACT DOCUMENTS.

C. Type CISP-H, Cast Iron Soil Pipe

1. Install per CISPI Cast Iron Soil Pipe and Fittings Handbook except as modified by the CONTRACT DOCUMENTS.
2. Make joints using neoprene sleeve and stainless steel clamps per manufacturer’s instructions to produce a liquid-tight joint without stressing sleeve.

D. Type CPR-U, Copper Underground

1. Clean tubing before installation. During the progress of construction, protect open ends of tubing, fittings and valves to prevent the admission of foreign matter. Place plugs in ends of installed work whenever work stops. Plugs shall be commercially manufactured products.
2. Cut copper tubing square for socket joints; remove burrs with approved cutting and reaming tools. Clean inside of fittings and outside surfaces of tubes in joint area with stainless steel wool before assembly of joint. Apply joint flux, filler material and heat source per the manufacturer’s instructions to provide proper capillary action to fill the

socket space and to achieve 100% of shear-line strength capability. Remake copper joints which fail pressure tests with new materials including pipe or tubing fittings and filler metal.

E. Epoxy Bonding To Existing Materials
   1. Use EPOXY BONDING COMPOUND to set sleeves or pipes in existing concrete or to bond dissimilar materials.
   2. The compound, when applied per the manufacturer's instructions, shall be capable of initial curing within 48 hours at temperatures as low as 40 degF and shall be capable of bonding any combination of the following properly prepared materials. Wet or dry, cured or uncured concrete or mortar; vitrified clay; cast iron, and carbon steel.

F. Jacking Of Pipe
   1. Do not jack pipe in place except upon prior approval of proposed materials and complete details of methods.

G. Hub Outlet
   1. At soil pipe stacks, vent stacks and roof conductors install hub end of TYPE CISP pipe flush with finished floor.
   2. Where indicated, terminate hub outlet 2 inches above finished floor.

H. Marking Tape
   1. Install approximately 6 to 8 inches below grades per manufacturer's instructions.

## 3.5 SURFACE PENETRATIONS

A. Provide sleeves where piping passes through floors and concrete or masonry walls.

B. Where sleeves are placed in existing concrete or masonry, utilize pipe size core drills and secure sleeves watertight with EPOXY BONDING COMPOUND. Do not load sleeves without approval of the ARCHITECT-ENGINEER.

C. Set sleeves flush with walls and 2 inches above finish floor, unless otherwise indicated.

D. For slab on grade and pit or sump wall penetrations, provide required annular space clearance full depth of slab, and utilize MECHANICALLY EXPANDABLE RESILIENT calking device.

## 3.6 FIELD QUALITY CONTROL

A. Flushing And Disinfection Work
   1. Perform cleaning of nitrogen and hydrogen piping per Division 15 Section "Aboveground Piping Systems."
   2. Perform flushing and disinfection work per Division 15 Section "Aboveground Piping Systems."
   3. Perform fire protection water system piping flushing work per NFPA Standard No. 13.

B. General Piping Systems Testing Requirements
   1. Prior to acceptance of the WORK, test piping systems in the presence of the ARCHITECT-ENGINEER, BNL Pressure Safety Representative, and authorities having jurisdiction, per respective and applicable governing codes and requirements of this SECTION. Conduct tests prior to concealing piping. Backfill to extent required to prevent movement.
   2. Provide necessary equipment and materials and make necessary test connections required to properly execute tests.
   3. Use only potable water for hydrostatic testing.
   4. Obtain water from point(s) designated by the ARCHITECT-ENGINEER. Promptly remove temporary connections upon completion of testing or when directed by the ARCHITECT-ENGINEER.
   5. Use dry, oil-free compressed air, carbon dioxide or nitrogen for pneumatic testing, unless otherwise approved.
   6. Remake leaking gasket joints with new gaskets and new flange bolting. Destroy old bolting. Where welded joints fail, submit proposed method of repair for approval by the ARCHITECT-ENGINEER. Testing shall take place during steady state ambient temperature conditions.
   7. Other than standard piping flanges, plugs, caps and valves, use only commercially manufactured expandable elastomer plugs for sealing off piping for test purposes. The safe test pressure rating of any plug used shall be not less than two times the actual test pressure being applied. Do not use expandable elastomer plugs for piping which could develop sufficient reactive force to cause damage to a structure, other piping, or cause moving of thrust or anchor provisions in case of blow-out.
   8. Remove components from piping systems during testing whenever the component may sustain damage due to test pressure or test media. After completion of the test, reinstall the component and retest at the component pressure rating with suitable media.
   9. Check system components such as valves for functional operation under system test pressure. Do not add test media to a system during a test for a period as specified or to be determined by ARCHITECT-ENGINEER. Duration of test shall be as specified.
   10. Prepare and maintain records of piping systems tests. Record ARCHITECT-ENGINEER and CONTRACTOR personnel responsibilities, dates, test gage identification numbers, ambient temperature, pressure ranges, rates of pressure drop and leakage rates.
   11. The connection between new underground piping and the existing shall be separately tested. Pressure specified in governing code shall be maintained on the joint for not less than 30 minutes.
   12. In the event testing demonstrates leakage rates in excess of specified limits, determine source(s) of leakage, repair or replace defective materials and workmanship and retest installation until compliance with specified requirements.

C. Acceptance Pressure Testing
   1. Perform pneumatic test in two stages, i.e., preliminary and acceptance. Do not perform pneumatic testing until personnel not directly involved in performing the testing have been evacuated from the area. Pneumatic testing of any system for any purpose shall require preliminary testing at pressure not exceeding 5 PSI. Testing at 5 PSI shall require swabbing joints with a commercial leak detector solution and subsequent observation for

bubbles. In the event that testing demonstrates that leakage rate exceeds specified limits, determine the source(s) of leakage, repair or replace defective materials and workmanship, and retest the installation until compliance with specified requirements.

2. Take necessary precautions to vent the expansive force of compressed air trapped during high pressure hydrostatic pressure testing to preclude injury and damage. The ARCHITECT-ENGINEER may require the removal of any system component including plugs and caps to ascertain whether the water has reached all parts of the system if purging or vent valves are not provided during construction.
3. Perform acceptance pressure testing as follows:

| | SERVICE | OPER. PRESS. (PSI) | TEST TYPE | TEST PRESS. (PSI) | PERMISSIBLE PRESS. DROP & HOLD PERIOD (PSI/HOURS) |
|---|---|---|---|---|---|
| a. | Condenser Water | | Hydrostatic | | 2/2 |

D. Sanitary Sewers (SAN)
1. GENERAL
   a. Test per requirements of the governing codes.
2. HYDROSTATIC TEST
   a. Apply test pressure after venting entire or completed portions of the system. Each piping joint shall be subjected to test pressure. Provide necessary supplementary vents to relieve trapped air, close openings, except highest opening. Fill system with water so that no joint is subjected to less than 10 foot static head but in no case in excess of manufacturer's recommended maximum pressure, for not less than 15 minutes prior to start of test and inspection period. There shall be no drop in water level for 15 minutes.
3. PNEUMATIC TEST (FOR 24 INCH DIAMETER AND SMALLER)
   a. Apply pneumatic test in the event of possible water freezing or at CONTRACTOR'S option. Apply test pressure to entire system or to portions thereof. However, each piping system joint shall be subjected to test pressure.
   b. Close openings and apply, safely pressure regulated and relieved, compressed air or inert gas to a pressure of 5 PSI. Maintain test pressure for a period not less than 15 minutes without need to introduce additional test medium. Leakage detection may be expedited by addition of a safe odorant such as oil of wintergreen.
4. ALIGNMENT TEST
   a. Visual test by ARCHITECT-ENGINEER, by any method he elects to use, after not less than two feet of backfill is in place.

E. Storm Sewers (ST)
1. GENERAL
   a. Test per requirements of the governing codes.

2. EXFILTRATION TEST
    a. Apply hydrostatic test to piping system, including manholes within present and future expansion building perimeter, essentially as specified for SANITARY SEWERS, except as modified and supplemented hereunder.
    b. Soak porous materials for not less than 24 hours prior to start of test. Apply test pressure in range of 10 to 25 feet static head. Leakage rate shall not exceed 0.6 gallons per inch of pipe diameter per 100 feet of pipe per hour.
3. ALIGNMENT TEST
    a. Visual test by ARCHITECT-ENGINEER, by any method he elects to use, after not less than 2 feet of backfill is in place.

## 3.7 CLEANING AND FINISHING

A. Upon completion of work in each respective area, clean and protect work. Just prior to final acceptance, perform additional cleaning as necessary to provide clean equipment and areas to the OWNER.

END OF SECTION

| Revision History | |
|---|---|
| **Date** | **Rev. No.** |
| A | 0 |
| B | 0 |
| C | 0 |
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